CHAPTER I

INTRODUCTION

1.1 Background

Color is an important quality attribute in food products. It influences consumer choice and preferences (Pathare *et al*., 2013). There are two types of coloring: synthetic and natural coloring. Synthetic food colorings are made from chemicals that are not present in nature (Vojdani and Vojdani, 2015). They are widely used in food, especially confectionery industry, due to their high stability, strong colour and relatively cheap. According to Vojdani and Vojdani (2015), synthetic coloring is linked to various adverse effects including allergic reactions, behavioral problems in children, and neurocognitive disorders. Hence, synthetic coloring raises concerns regarding their potential health impact especially to children. Due to these concerns, there is a growing trend towards replacing synthetic colorants with natural alternatives. Natural food colorings are made from renewable sources and the majority are of plant origin (Mesiry *et al*., 2021). The main natural pigments that are present in nature include anthocyanins, carotenoids, flavanoids, chlorophyll, crocin, and betalain that are extracted from horticultural plants (Mesiry *et al*., 2021). Unlike synthetic coloring, natural coloring is not widely used in the confectionery industry due to the tedious extraction procedures, low color value, and higher cost (Rymbai and Srivastav, 2011). It is also known to be unstable under various conditions, for example temperature, pH, and light. This causes difficulty during processing and storage.

However, natural coloring has fewer allergic reactions, contribute nutrients and antioxidants, and does not risk children's health (Lis and Bartuzi, 2023).

Dragon fruit (*Hylocereus polyrhizus*) is a tropical fruit that belongs to the family Cactaceae from the genus Hylocereus which is also known as a one of the sources of natural pigment. Dragon fruit pulp is rich in anthocyanins and betalains, a group of pigments similar to those found in beetroot. Betalains are classified into two categories: red-purple betacyanins and yellow-orange betaxanthins. Betacyanins are particularly effective for coloring low-acid foods, like dairy products, as they are comparable to synthetic colorants and maintain their hue across a broad pH range from 3 up to 7 (Sambasevam, 2020). Betacyanin also stands out from anthocyanin because it produces a brighter red color (Fernández-López *et al.,* 2020). The same as typical natural pigments, both betacyanins and anthocyanins in dragon fruit also face the problem of stability, especially in their direct application in food products.

Confectionery is one of the food products that always need coloring and also need high temperature during processing stages. Marshmallow is one of the confections with foam-like structure made from sugar, glucose syrup, gelatin and coloring with addition of high air that produce soft texture and melting sensation when chewed. Marshmallows are one of the confectionery products that has become a popular snack among children, especially for their sweet taste and springy texture. Most commercial marshmallows are generally white; but to attract consumer interest, especially for children, some have light color. Synthetic coloring is usually added to the marshmallow due to its economical, practical, and

stable coloring properties (Ann, 2012). Therefore, marshmallow is a good choice of product to study the stability of water-based dragon fruit extract in confectionary product application.

1.2 Research Problem

Synthetic coloring is commonly used in the marshmallow industry due to its higher stability and economic value. However, synthetic colorings may have potential long-term health risks, especially when consumed excessively. Natural coloring has the potential to overcome the problems of health risks, but they tend to have problems with stability during processing and storage. Temperature, pH and light are the most common parameters in food processing affecting the stability of natural pigments. Therefore, a study to evaluate the influence of natural pigments in food product application is needed.

Dragon fruit juice is one of fruits containing red purplish color from both anthocyanins and betacyanin that can be applied to various food products as natural coloring. As natural pigments, the effectiveness of these pigments in food applications may vary depending on their concentration and how they interact with specific food matrices. Confectionery products are a range of products that almost always need color and use relatively high temperature in their processing stages. Marshmallow is one of the confectionery products. Marshmallows present a unique formulation challenge due to their low moisture content, sugar composition, and thermal processing. Therefore, dragon fruit and marshmallow are suitable to evaluate how varying concentrations of dragon fruit extract and storage conditions influence the anthocyanin and betacyanin changes in

marshmallow.

1.3 Objectives

1.3.1 General Objective

To study the potency of water-based dragon fruit extract as the source of natural coloring in marshmallow application.

1.3.2 Specific Objectives

1. To study the characteristic of water-based dragon fruit extract before and after evaporation.
2. To study the effect of water-based dragon fruit extract concentration and storage condition on the total anthocyanins, betacyanins, phenolic, antioxidant activity, and color stability of the extract in marshmallow application.
3. To determine the best concentration of water-based dragon fruit extract and storage condition having the most stable color in marshmallow application during 2 weeks storage.